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[DE/DE]; Advanced Technology Center Stuttgart, Sony International (Europe) GmbH, Heinrich-Hertz-Str. 1, 70327 Stuttgart (DE). HÖFFLINGER, Jens [DE/DE]; Advanced Technology Center Stuttgart, Sony International (Europe) GmbH, Heinrich-Hertz-Str. 1, 70327 Stuttgart (DE).

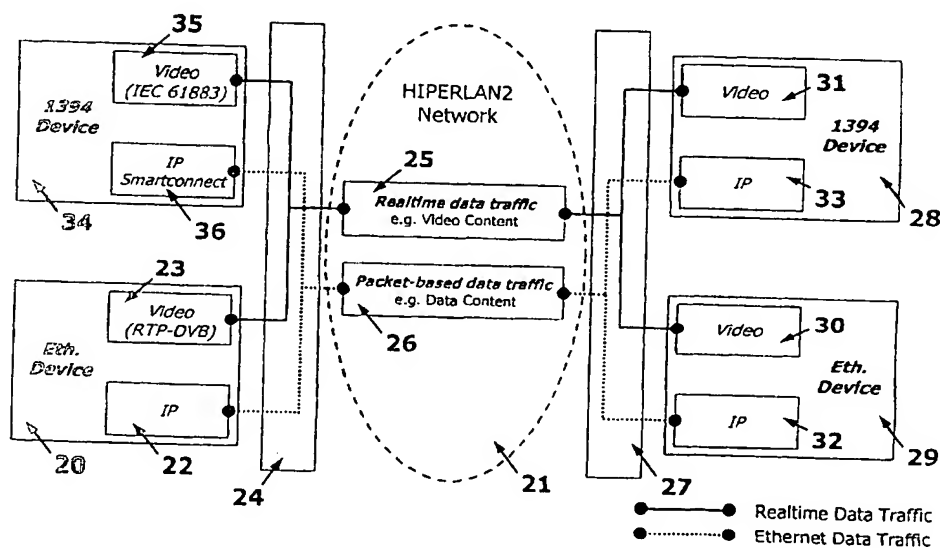(74) Agent: MÜLLER, Frithjof, E.; Müller . Hoffmann & Partner, Innere Wiener Strasse 17, 81667 München (DE).

(54) Title: CONVERGENCE LAYERS FOR NETWORK DEVICES AND METHOD FOR TRANSMITTING DATA TRAFFIC

(57) Abstract: A network device for an ad-hoc established device network is described, which comprises a content detection layer for detecting the content type of external traffic received by said network device. According to the content type, the external traffic is routed to a content-specific convergence layer dedicated to handling the respective content type. Said content-specific convergence layers exchange network traffic with other network devices via content-specific connections that are suited to the requirements of the respective content type. On the part of a target network device, the received data stream can be routed to any external protocol. Thus, the device network allows interoperability between different external networking protocols.

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Convergence Layers for Network Devices and
Method for Transmitting Data Traffic

The invention is related to a network device for use in an ad-hoc esta-
5   blished device network, to a device network, and to a method for transmit-
ting data traffic via a device network.

For a variety of home multimedia applications and business applications, it
is important to establish networks, preferably wireless networks, for ex-
10   changing data and messages between different devices that are part of the
network. In a typical business application scenario, a mobile terminal gets
services over a fixed corporate or public infrastructure. In an exemplary
home application scenario, a low-cost and flexible networking is supported
to interconnect wireless digital consumer devices.

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The ETSI Project BRAN (Broadband Radio Access Networks) has defined the
standard HiperLAN (High Performance Radio Local Area Network), which
provides high-speed multimedia communications between different broad-
band core networks and mobile terminals. HiperLAN/2 provides a flexible
20   platform for a variety of business and home applications that can support a
set of bit rates up to 54 Mbit/s. The HiperLAN/2 standard is an example
how data can be transmitted between different devices in a wireless net-
work. The invention is not limited to wireless networks according to the Hi-
perLAN/2 standard, though. The invention is not limited to wireless net-
25   works. It can also be applied in wired networks.

A typical device network comprises several devices, with one of the devices
acting as a controller that controls the other devices that act as mobile ter-
minals. When different devices are brought within reach of each other, they
30   start exchanging messages and establish a so-called ad-hoc network, with
one of the devices assuming the control functionality.

In section 6.2 of ETSI BRAN HiperLAN2 Standard Spec: DLC home extensi-
on (ETSI TS 101 761-4 V1.3.2 (2002-01), it is described how multiple con-
35   vergence layers supporting different external networking standards can be
active simultaneously within one wireless local area network.

1   It is an object of the invention to provide a network device and a method for
         routing data traffic of an external networking protocol through a local area
         network, whereby interoperability between different external networking
         technologies is supported.

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         The object of the invention is solved by a network device according to claim
         1, by a device network according to claim 13, and by a method for trans-
         mitting data traffic via a device network according to claim 21. A computer
         program product according to the present invention is defined in claim 24
10   and a computer readable storage medium is defined in claim 25.

         According to the invention, the network device for a device network compri-
         ses a content detection layer for detecting the content type of external traf-
         fic received by said network device. In dependence of the detected content
15   type, said external traffic is passed to a content-specific convergence layer
         that is dedicated to handling the respective content type. Furthermore, the
         network device comprises a set of content-specific convergence layers,
         which exchange network traffic with other network devices of said device
         network via content-specific connections. Said content-specific connections
20   are suited to the requirements of the respective content type.

         In prior art solutions, external traffic received by a network device has been
         passed, according to the protocol of said external traffic, to a protocol-spe-
         cific convergence layer. For example, IEEE 1394 data traffic has always
25   been handled by a IEEE 1394-specific convergence layer, and Ethernet traf-
         fic has been handled by an Ethernet-specific convergence layer. The respec-
         tive convergence layer has been responsible for transmitting the external
         traffic to its respective target network device, whereby the connection for
         transmitting the external traffic within the device network has been set up
30   according to said external network.

         According to the invention, when external traffic is received by a network
         device, the content type of said external traffic is detected by a content de-
         tection layer. For example, it might be detected that the external traffic is
35   "packet-based data traffic". Alternatively, said external traffic might be
         "real-time critical data traffic", for example an audio or video data stream.
         When the content type has been detected, the received data traffic is pas-

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1   sed to a convergence layer that is specific for said type of content. Thus, in-
     stead of protocol-specific convergence layers, content-specific convergence
     layers are used for setting up and releasing connections to other network
     devices within the network, and for transmitting data traffic within the de-
5   vice network. The content specific connections that are built up by the con-
     tent-specific convergence layers are suited to the requirements of the re-
     spective content type.

     The invention is based on the fact that the requirements for a data trans-
10   mission within a device network do not depend on the protocol of the exter-
     nal traffic in the first place. It is possible to transmit packet-based data
     traffic via a IEEE 1394 interface (IPover1394), though the standard IEEE
     1394 is mostly used for the transmission of video data streams. Vice versa,
     it is also possible to transmit real-time critical data via an IP network,
15   which is typically used for packet-based data transmission. The require-
     ments for a data transmission within the device network depend in the first
     place on the content type of the external traffic. The requirements imposed
     by the content type define the parameters of the data connection that is
     established between the source network device and the target network de-
20   vice. For example, a real-time critical video data stream requires that the
     transmission delay never exceeds a predefined threshold, and that a fixed
     bandwidth is permanently available for said data transmission. Generally,
     there are no such restrictive requirements for packet-based data transmis-
     sion.

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     According to the invention, for each content type, a specific convergence
     layer is provided, which handles data streams of said content type accor-
     ding to the content-specific requirements. The content-specific convergence
     layers are responsible for establishing and releasing content-specific con-
30   nections within the device network, and for transmitting the respective ex-
     ternal data traffic within the device network.

     Within the network, the external traffic is transmitted from the source net-
     work device, which has received said traffic from an external network, to a
35   target network device. On the part of the target network device, the arriving
     data stream is taken care of by a corresponding convergence layer that is
     responsible for the respective content type. To said target network device,

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any external network may be connected. The convergence layer on part of the target network device doesn't have to route the traffic to the external protocol said traffic has emanated from. Instead, the received data traffic may be mapped to any external protocol that is able to accept the respective content type. For example, a video data stream emanating from a IEEE 1394 interface can be mapped, after it has been transmitted within the device network, to a IEEE 1394 interface again. Alternatively, the video data stream can also be mapped, on part of the target network device, to an IP interface. This kind of data exchange between different external networking technologies has not been possible in the prior art. The inventive concept of content-specific convergence layers allows for an interoperability between different external networking standards. In case two completely different external network protocols can handle the same content type, it is possible to receive external traffic of a first external protocol, route said traffic through the device network, whereby an internal protocol is used, and map the traffic, on the part of the receiving network device, to a second external protocol. The device network can be seen as an adapting means for adapting a first kind of external traffic to a second kind of external traffic.

One advantage of the inventive solution is that the available bandwidth of the device network is used more effectively by allowing access to different traffic types. Another advantage is that new networking technologies and traffic types can be integrated easily into the existing convergence layer architecture. Due to the generic design of the relevant modules, large amounts of existing code can be reused in the process of the integration.

Preferably, one of said content types is real-time critical data, whereby said set of content-specific convergence layers comprises a convergence layer dedicated to handling real-time critical data. When real-time critical data, for example an audio or video data stream, is transmitted from a first network device to another network device of the device network, the following requirements have to be fulfilled: First of all, transmission delays that exceed a certain amount are not acceptable. Furthermore, for the transmission of a real-time critical data stream, a certain bandwidth has to be permanently available in order to allow for a continuous transmission of said data stream. A convergence layer dedicated to handling real-time critical data can set up content-specific connections within the device network that

1   allow to fulfil the above-mentioned requirements.

        Further preferably, one of said content types is packet-based data, whereby
        said set of content-specific convergence layers comprises a convergence
5   layer dedicated to handling packet-based data. When regular packet-based
        data traffic has to be transmitted within the device network, there are no
        specific requirements concerning the transmission delay and available
        bandwidth as there are in case of real-time critical data. A convergence lay-
        er dedicated to handling packet-based data will therefore set up a content-
10   specific connection for the transmission of said data, whereby the available
        network resources are used in a more flexible way. In particular, it is not
        necessary to reserve a predefined bandwidth for the transmission of said
        packet-based data.

15   According to a preferred embodiment of the invention, said external traffic
        is at least one of Ethernet traffic, IEEE 1394 traffic, UMTS traffic or PPP
        traffic. The Ethernet protocol is the major protocol for accessing the inter-
        net. IEEE 1394 is the most common standard for data exchange between
        audio and video devices and allows for large transmission bit rates. UMTS
20   is an example for a third generation mobile communications protocol; and
        PPP (point-to-point protocol) permits to establish point-to-point connecti-
        ons between two devices. Thus, the network device can be connected to a
        large range of current networking technologies simultaneously.

25   Preferably, said network device comprises hardware connectivity for at least
        one of Ethernet traffic, IEEE 1394 traffic, UMTS traffic or PPP traffic. Data
        packets received via said hardware connections are converted into the in-
        ternal network protocol of the device network. Vice versa, data packets of
        the internal network protocol received from other network devices are con-
30   verted into data packets of the external networking technology. Then, these
        data packets are sent to the external network via said hardware connec-
        tion.

        Preferably, said network device is an access point of said device network.
35   The task of an access point is to provide access to different external net-
        working technologies and networking services, for example to the internet.
        Therefore, the access points should be equipped with multiple content-spe-

1   cific convergence layers in the first place, because said access points have
     to handle different kinds of data traffic received from various external net-
     works.

5   According to a preferred embodiment of the invention, said content detec-
     tion layer analyses if said Ethernet traffic is real-time critical traffic, e.g. in
     connection with RTP, RTCP, RSVP, or RTSP traffic, whereby in case said
     Ethernet traffic is real-time critical, it is passed to a convergence layer de-
     dicated to handling real-time critical data. Each data packet of Ethernet
10   data traffic comprises type field information indicating the content of the
     respective Ethernet data packet. Thus, the content detection layer can ea-
     sily determine if said Ethernet traffic is real-time critical or not. If the re-
     sult of analysing the type field information is that said Ethernet traffic is
     real-time critical, it is passed to the convergence layer that handles real-
15   time critical data. Therefore, in the case of Ethernet packets, the detection
     of the respective content type can be implemented in a very simple way.

     Further preferably, said content detection layer analyses if said Ethernet
     traffic is not real-time critical traffic, i.e. of some other protocol type and
20   thus packet-based traffic, whereby in case said Ethernet traffic is not real-
     time critical, it is passed to a convergence layer dedicated to handling
     packet-based data. The type field information of an Ethernet packet indica-
     tes the content of said data packet. The content detection layer can easily
     detect whether the received Ethernet traffic is packet-based data traffic or
25   not. Packet-based data traffic is passed to a convergence layer dedicated to
     handling this content type.

     Preferably, said content detection layer analyses if said IEEE 1394 traffic is
     packet-based data traffic, whereby in case said IEEE 1394 traffic is packet-
30   based data traffic, it is passed to a convergence layer dedicated to handling
     packet-based data. Further preferably, said content detection layer analy-
     ses if said IEEE 1394 traffic is real-time critical data traffic, whereby in
     case said IEEE 1394 traffic is real-time critical data traffic, it is passed to a
     convergence layer dedicated to handling real-time critical data. Via a IEEE
35   1394 interface, either real-time critical IEEE 1394 data traffic or packet-
     based data traffic (IPover1394) can be transmitted. Also with regard to
     1394 traffic, it is possible to analyse at low expense the respective content

1   type. According to the content type, the IEEE 1394 traffic is either passed
     to a convergence layer for handling real-time critical data, or to a conver-
     gence layer for handling packet-based data traffic.

5   According to a preferred embodiment of the invention, said content-specific
     convergence layers comprise a common part, which segments data packets
     of said external traffic into a multitude of corresponding data packets of
     said device network's internal protocol, and which reassembles data pak-
     kets of said device network's internal protocol into corresponding data pak-
10   kets of the respective external traffic. All the external networking technolo-
     gies mentioned so far have one thing in common: They use variable size
     data packets which comprise more bytes than the rather small LCH (Long
     Transport Channel) data packets used within the HiperLAN/2 network,
     which only comprise 48 bytes. Therefore, data packets of the external pro-
15   tocol have to be segmented into a multitude of HiperLAN/2 data packets.
     Data packets received from the HiperLAN/2 network have to be reassem-
     bled into the data packets of the respective external protocol. Instead of
     providing each one of the convergence layers with a unit for segmenting
     and reassembling data packets, this task is accomplished, for all the con-
20   vergence layers, by the common part of the convergence layers. The com-
     mon part segments data packets arriving from the respective external net-
     work into a multitude of data packets of the internal network's protocol,
     and reassembles data packets of the internal protocol into variable size
     data packets of the respective external protocol. By implementing said com-
25   mon part, the structure of the content-specific convergence layers can be
     simplified. Another advantage is that in case a new convergence layer for
     another content type is to be implemented, programming said new conver-
     gence layer is simplified, because the functionality of the common part can
     be used.

30

     Preferably, said content-specific convergence layers are operable to be used
     simultaneously within the same device network. Therefore, a network de-
     vice can simultaneously handle data streams of different content type.

35   According to the invention, a device network is set up, which comprises at
     least one network device with a content detection layer, and with a set of
     content-specific convergence layers as described above.

1   Preferably, content-specific connections are set up and released between the network devices of said device network, whereby a content-specific connection is set up between a content-specific convergence layer of a first network device which supports a certain content type, and a respective

5   content-specific convergence layer of a second network device which supports the same content type. Between convergence layers supporting the same content type, a connection can be established. As soon as the connection is established, any amount of data packets can be transmitted between the two content-specific convergence layers. By defining content-specific

10   connections for handling data transmissions within the ad-hoc established device network, it is possible to define the parameters of the data transmission according to the content type, and to choose these parameters according to the desired bandwidth, error handling, etc.

15   According to a preferred embodiment of the invention, the external traffic exchanged with said content-specific convergence layer of said first network device may be of a different kind than the external traffic exchanged with said content-specific convergence layer of said second network device. On the part of the target network device, the received data stream may be for-

20   warded to any external protocol that is willing and able to accept the respective content type. The data stream that has been transmitted via the ad-hoc established device network can thus be distributed to an external network that is different from the external network the data stream has emanated from. Data traffic from a first external networking technology

25   may be routed to a second external networking technology. The device network serves as an adapting means for all kinds of network traffic. This makes the device network, preferably the wireless LAN technology, much more powerful and flexible.

30   Preferably, in case said content-specific connection is for a content type which requires a quality of service feature, a fixed bandwidth is reserved for said content-specific connection. The "quality of service" feature is a well-known feature for the transmission of video data. A certain bandwidth is reserved for the transmission of the video data stream, and thus, a cer-

35   tain quality of service (QoS) is guaranteed. When transmitting video data streams or any other data traffic supporting the quality of service feature via a device network, it is possible to set up the connection in a way that

1   the quality of service feature is supported.

Further preferably, for each content-specific connection, the content type supported by said content-specific connection is registered. Any traffic

5   transmitted via the content-specific connection can be passed, on the part of the target network device, to the corresponding content-specific conver- gence layer dedicated to handling the respective content type.

Further preferably, said device network is a wireless local area network

10   (WLAN), and in particular a HiperLAN/2 network. HiperLAN/2 is a Europe- an standard for wireless local area networks.

According to a preferred embodiment of the invention, the exchange of con- trol messages and data packets between different network devices of said

15   device network is effected according to a TDMA transmission scheme. Pre- ferably, a set of time slots of said TDMA transmission scheme may be reser- ved for a certain content-specific connection. By doing this, a predefined transmission capacity can be assigned to a certain connection. This is one way of realizing the above-mentioned quality of service feature.

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Further features and advantages of preferred embodiments according to the present invention will be explained below in conjunction with the accom- panying drawings, in which

25   **Fig. 1**   shows how different networking technologies interact in order to provide a networking environment;

Fig. 2   shows a wireless local area network comprising two network devices according to the prior art;

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Fig. 3   shows a wireless local area network, whereby both real-time critical and regular packet-based data streams are transmitted via the wi- reless LAN;

35   **Fig. 4**   depicts the structure of the protocol stack for the HiperLAN/2 standard; and

1   **Fig. 5**   shows how higher layer packets, for example Ethernet packets,
are mapped onto layers of the HiperLAN/2 standard.

Fig. 1 shows the interplay of different network protocols in a networking
5   environment. The Internet 1 provides the backbone for all kinds of data ex-
change services. In an office environment 2, servers 3 and access points 4
for wireless data transmission are connected by means of the Ethernet pro-
tocol. In order to establish wireless local area networks for connecting mo-
bile terminals 5 to said access points 4, the Ethernet protocol can be con-
10   verted into a suitable protocol for wireless data transmission, e.g. into the
HiperLAN/2 protocol. Also in a home environment 6, the HiperLAN/2 proto-
col is used for establishing an ad-hoc device network for exchanging data
between audio and video devices 7, personal computers 8, organizers 9,
etc. In the field of mobile communication 10, the standards GPRS and
15   UMTS are used for exchanging data packets between mobile devices 11 and
base stations 12, and for accessing the Internet 1. For small distances, the
Bluetooth protocol is used. For all these applications, the Internet Service
Provider 13 provides a high-bandwidth backbone 14 and all kinds of data
exchange services (email, world wide web, WAP, FTP, etc.).
20

In Fig. 2, a wireless local area network of the prior art is shown. The wire-
less local area network comprises an access point 15, which acts as a cen-
tral controller for the network, and a mobile terminal 16. The mobile termi-
nal 16 exchanges data packets with the access point 15 via the HiperLAN/2
25   protocol. The access point 15 comprises hardware connectivity for an exter-
nal network protocol, the Network Type 1 (18), e.g. for the Ethernet. Furt-
hermore, the access point 15 comprises a Network Type 1 convergence lay-
er 17 for converting data packets received via the Network Type 1 (18) into
the HiperLAN/2 standard (19), and for converting data packets received via
30   the HiperLAN/2 (19) into the Network Type 1 standard (18).

In Fig. 3, a device network comprising four network devices with content-
specific convergence layers are shown. An Ethernet device 20, which is con-
nected to the Ethernet via IP (Internet Protocol), is part of the device net-
35   work 21. Preferably, the device network is a wireless local area network
(LAN), in particular according to the HiperLAN/2 standard. The Ethernet
device 20 can receive regular IP traffic 22 from the Internet. Regular

1   packet-based IP traffic is transmitted according to protocols aside from tho-
se that are explicitly used for real-time critical data (e.g. RTP, RTCP, RSVP,
or RTSP). The Ethernet device 20 can also receive real-time critical data
traffic 23 via the Ethernet interface, e.g. a video data stream. For the trans-

5   mission of real-time critical data traffic via an IP network, currently the
protocols RTP (Real-Time Protocol), RTCP (Real-Time Control Protocol),
RSVP (resource ReSerVation Protocol), and RTSP (Real-Time Streaming Pro-
tocol) are used.

10   Let us assume that real-time critical video data stream 23 emanating from
the Ethernet device 20 shall be transmitted via the device network 21 to
other network devices. The video data stream 23 is first passed to a content
detection and routing layer 24, and said content detection and routing lay-
er 24 detects that the arriving data stream utilizes one of the real-time cri-

15   tical protocol types. Therefore, the content type is identified as "real-time
critical data traffic". Accordingly, the real-time critical data stream is for-
warded to a convergence layer 25 dedicated to handling "real-time critical
data traffic". Besides the convergence layer 25, other content-specific con-
vergence layers exist, e.g. the convergence layer 26, which is dedicated to

20   handling "packet-based data traffic".

The content-specific convergence layer 25 establishes a content-specific
connection with a corresponding convergence layer on the part of the target
network device. In case real-time critical data traffic has to be transmitted,

25   the convergence layer 25 reserves a certain predefined bandwidth when
establishing the connection to the respective target network devices. Then,
the IP data packets of the real-time critical data traffic are segmented into
a set of corresponding data packets of the internal protocol of the device
network 21. This task can be carried out by a separate module which is a

30   common part of the content-specific convergence layers 25 and 26. In case
the device network 21 is a HiperLAN/2 network, 48 byte packets of the type
LCH (Long Transport Channel) are used within the device network 21.

Now, the video data stream 23 of our example is transmitted via the device

35   network 21 to the respective target network devices. There, the arriving
data packets are forwarded to a content detection and routing layer 27. In
case a target network device, e.g. a IEEE 1394 device 28 or an Ethernet de-

1   vice 29, has indicated that it is willing to accept a respective traffic type,
       the content detection and routing layer 27 forwards the received data stre-
       am to the respective target device. In case the Ethernet device 29 has indi-
       cated that it is willing to accept the video data stream, the received video
5   data stream is routed (30) to the Ethernet device 29. There, the short LCH
       data packets are reassembled to build IP packets, and the real-time critical
       video data stream is again converted into an appropriate protocol for real-
       time critical data. The video data stream can then be forwarded to the IP
       network to which the Ethernet device 29 is connected.

10
       So far, it has been described how the video data stream 23, which is an IP
       data stream, is converted to the device network's internal protocol and
       transmitted via said device network to another Ethernet device 29. The vi-
       deo data stream 23, which has emanated from an IP network, doesn't have
15   to be routed to an Ethernet device, though. The content detection and rou-
       ting layer 27 can also route the received real-time critical data stream to
       the IEEE 1394 device 28 when the IEEE 1394 device 28 requests it. On
       part of the IEEE 1394 device 28, the LCH data packets of the internal pro-
       tocol are reassembled into a video data stream 31 according to the IEEE
20   1394 protocol. The real-time critical video data stream can then be forwar-
       ded to the IEEE 1394 network to which the IEEE 1394 device 28 is connec-
       ted. The inventive concept of content-specific convergence layers and con-
       tent-specific routing allows to transform a real-time critical IP data stream
       into an IEEE 1394 data stream. Besides that, it is also possible to transmit
25   the real-time critical video data stream 23 emanating from the Ethernet to
       both an Ethernet device 29 and a IEEE 1394 device 28.

       In the following, a second example will be discussed. On the part of the
       Ethernet device 20, regular IP traffic 22 is received from the Internet. The
30   regular IP traffic is passed to the content detection and routing layer 24,
       which detects that the content type is "packet-based data traffic", which is
       not real-time critical. The regular IP traffic 22 is then passed to the conver-
       gence layer 26, which is dedicated to handling "packet-based data traffic".
       The IP packets are segmented into the LCH data packets used within the
35   HiperLAN/2 network. A connection is set up within the device network 21,
       and the data traffic is transmitted to the content detection and routing lay-
       er 27. From there, the traffic can be routed to the Ethernet device 29. The

1   received packets of the internal protocol are reassembled into IP packets,
        and the IP data stream 32 is obtained.

        Alternatively or additionally, the data traffic can be routed from the content
5   detection and routing layer 27 to the IEEE 1394 device 28. There, the recei-
        ved packets of the internal protocol are reassembled into data packets ac-
        cording to the IEEE 1394 standard. Though the IEEE 1394 standard is in-
        tended for the transmission of audio and video data streams in the first
        place, it is also possible to transmit IP data packets via an IEEE 1394 in-
10   terface. This is called "IPover1394". Such an "IPover1394" data stream 33
        is obtained on the part of the IEEE 1394 device 28.

        Both real-time critical data streams and regular packet-based data traffic
        can also emanate from a IEEE 1394 device 34 that is connected to an ex-
15   ternal IEEE 1394 network. The video data stream 35 can be transmitted
        from the IEEE 1394 device 34 via the convergence layer 25 and the device
        network 21 to the IEEE 1394 device 28, or to the Ethernet device 29, or to
        both said devices. The IPover1394 data traffic 36 is passed to the conver-
        gence layer 26, which handles packet-based data traffic. Via the device net-
20   work 21, the data traffic is routed to the IEEE 1394 device 28, or to the
        Ethernet device 29, or to both said devices.

        In Fig. 4, the so-called protocol stack for the HiperLAN/2 standard is
        shown. The bottom layer is the Physical Layer 37, which deals with the mo-
25   dulation type and the actual data transmission. The next layer is the Medi-
        um Access Control (MAC) 38, which is part of the Data Link Control Layer
        (DLC) 39. The MAC 38 schedules the data for transmission. A TDMA (Time
        Division Multiple Access) frame with time slots of 2 ms is used, and the
        MAC 38 assigns time slots of the TDMA frame to the various connections
30   within the HiperLAN/2 network. The TDMA frame generated by the MAC 38
        is the typical transmission standard in the HiperLAN/2 protocol. The Data
        Link Control Layer 39 further comprises an Error Control functionality 40.
        Furthermore, the Data Link Control Layer 39 comprises a Radio Link Con-
        trol Sublayer (RLC) 41.

35
        The highest layers of the HiperLAN/2 standard are the convergence layers
        42, which comprise a content type detection and routing layer 43, a set of

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content-specific convergence layers 44, 45, and a common part 46 of said convergence layers. The content type detection and routing layer 43 detects the content type of arriving data traffic and passes said traffic to a corresponding content-specific convergence layer. The convergence layer 44 handles packet-based data traffic, whereby the convergence layer 45 handles real-time critical data traffic.

The common part 46 segments the variable size data packets of the respective external protocol into a multitude of data packets according to the HiperLAN/2 standard. Besides that, the common part 46 converts HiperLAN/2 packets into data packets of an external protocol by reassembling the HiperLAN/2 packets.

The respective hardware connectivity is addressed by means of drivers 47, 48, 49. The convergence layer 47 is responsible for handling the PPP (point-to-point) protocol, which is an external protocol used for point-to-point connections. The driver 48 supports the IEEE 1394 protocol, and the driver 49 supports the Ethernet protocol.

In Fig. 5, it is shown how higher layer packets, for example Ethernet packets, are mapped onto layers of the HiperLAN/2 standard. Again, the Physical Layer PHY is the bottom layer, and a PHY burst 52 comprising several Long Transport CHannel Packets (LCH) is shown. At the Data Link Control Layer (DLC), a Long Transport CHannel Packet (LCH) 53 is divided into a header 54, a DLC SDU 55, and a Cyclic Redundancy Check (CRC) 56. At the Convergence Layer (CL), the DLC SDU 55 is divided into 12 bits of flags (57) and 384 bits or 48 bytes of Payload (58). A higher layer packet, e.g. an Ethernet packet 59, is segmented into a multitude of these 48 bytes packets 58, 60, which are transmitted as LCH packets according to the HiperLAN/2 standard.

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Claims

1. Network device for a device network, **characterized by**
- a content detection layer (24, 43) for detecting the content type of external traffic received by said network device, and for passing said external traffic, in dependence of the detected content type, to a content-specific convergence layer (25, 26, 44, 45) dedicated to handling the respective content type, and
- a set of content-specific convergence layers (25, 26, 44, 45), which exchange network traffic with other network devices (28, 29) of said device network (21) via content-specific connections, whereby said content-specific connections are suited to the requirements of the respective content type.

2. Network device according to claim 1, **characterized in that** one of said content types is real-time critical data, whereby said set of content-specific convergence layers comprises a convergence layer dedicated to handling real-time critical data.

3. Network device according to claim 1 or 2, **characterized in that** one of said content types is packet-based data, whereby said set of content-specific convergence layers comprises a convergence layer dedicated to handling packet-based data.

4. Network device according to anyone of the preceding claims, **characterized in that** said external traffic being at least one of Ethernet traffic, IEEE 1394 traffic, UMTS traffic or PPP traffic.

5. Network device according to anyone of the preceding claims, **characterized in that** said network device comprises hardware connectivity for at least one of one of Ethernet traffic, IEEE 1394 traffic, UMTS traffic or PPP traffic.

6. Network device according to anyone of the preceding claims, **characterized in that** said network device is an access point of said device network.

1   7.   Network device according to anyone of the preceding claims, **charac-terized in that** said content detection layer analyses if said Ethernet traffic is real-time critical traffic, whereby in case said Ethernet traffic is real-time critical, it is passed to a convergence layer dedicated to handling

5   real-time critical data.

     8.   Network device according to anyone of the preceding claims, **charac-terized in that** said content detection layer analyses if said Ethernet traffic is not real-time critical traffic, whereby in case said Ethernet traffic is

10   not real-time critical, it is passed to a convergence layer dedicated to handling packet-based data.

     9.   Network device according to anyone of the preceding claims, **charac-terized in that** said content detection layer analyses if said IEEE 1394

15   traffic is packet-based data traffic, whereby in case said IEEE 1394 traffic is packet-based data traffic, it is passed to a convergence layer dedicated to handling packet-based data.

     10.   Network device according to anyone of the preceding claims, **charac-

20   terized in that** said content detection layer analyses if said IEEE 1394 traffic is real-time critical data traffic, whereby in case said IEEE 1394 traffic is real-time critical data traffic, it is passed to a convergence layer dedicated to handling real-time critical data.

25   11.   Network device according to anyone of the preceding claims, **charac-terized in that** said content-specific convergence layers comprise a common part, which segments data packets of said external traffic into a multitude of corresponding data packets of said device network's internal protocol, and which reassembles data packets of said device network's inter-

30   nal protocol into corresponding data packets of the respective external traffic.

     12.   Network device according to anyone of the preceding claims, **charac-terized in that** said content-specific convergence layers are operable to be

35   used simultaneously within the same device network.

     13.   Device network, comprising at least one network device according to

anyone of claims 1 to 12.

14.   Device network according to claim 13, **characterized in that** content-specific connections are set up and released between the network devices of said device network, whereby a content-specific connection is set up between a content-specific convergence layer of a first network device which supports a certain content type, and a respective content-specific convergence layer of a second network device which supports the same content type.

15.   Device network according to claim 13 or 14, **characterized in that** the external traffic exchanged with said content-specific convergence layer of said first network device may be of a different kind than the external traffic exchanged with said content-specific convergence layer of said second network device.

16.   Device network according to anyone of claims 13 to 15, **characterized in that** in case said content-specific connection is for a content type which requires a quality of service feature, a fixed bandwidth is reserved for said content-specific connection.

17.   Device network according to anyone of claims 13 to 16, **characterized in that** for each content-specific connection, the content type supported by said content-specific connection is registered.

18.   Device network according to anyone of claims 13 to 17, **characterized in that** said device network is a wireless local area network (WLAN), and in particular a HiperLAN/2 network.

19.   Device network according to anyone of claims 13 to 18, **characterized in that** the exchange of control messages and data packets between different network devices of said device network is effected according to a TDMA transmission scheme.

20.   Device network according to claim 19, **characterized in that** a set of time slots of said TDMA transmission scheme may be reserved for a certain content-specific connection.

1   21.   Method for transmitting data traffic via a device network, **characterized by** the following steps:

- detecting a content type of external traffic arriving at the device network,

- passing said external traffic, in dependence of the detected content type,

5   to a content-specific convergence layer (25, 26, 44, 45) dedicated to handling the respective content type, and

- transmitting network traffic to other network devices (28, 29) via content-specific connections, whereby said content-specific connections are suited to the requirements of the respective content type.

10

22.   Method according to claim 21, **characterized in that** content-specific connections are set up between two network devices before transmitting said network traffic between said two network devices in accordance with said content type.

15

23.   Method according to claim 21 or 22, **characterized in that** after the network traffic between said two network devices has been transmitted in accordance with said content type, said content-specific connection between said two network devices is released.

20

24.   Computer program product comprising computer program means adapted to perform the method steps as defined in anyone of claims 21 to 23 when being executed on a computer, a digital signal processor or the like.

25   25.   Computer readable storage means, storing thereon a computer program product according to claim 24.
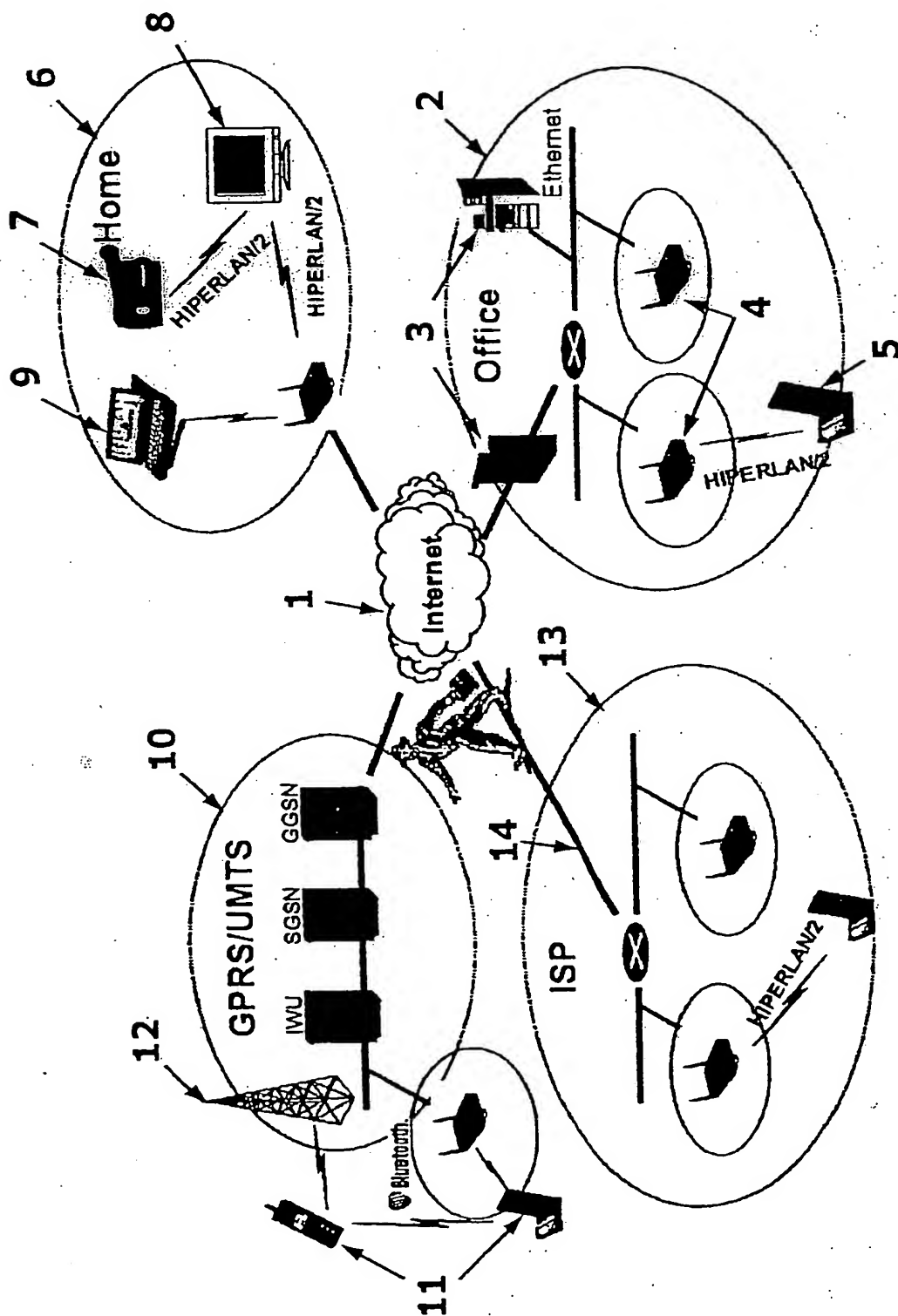
30

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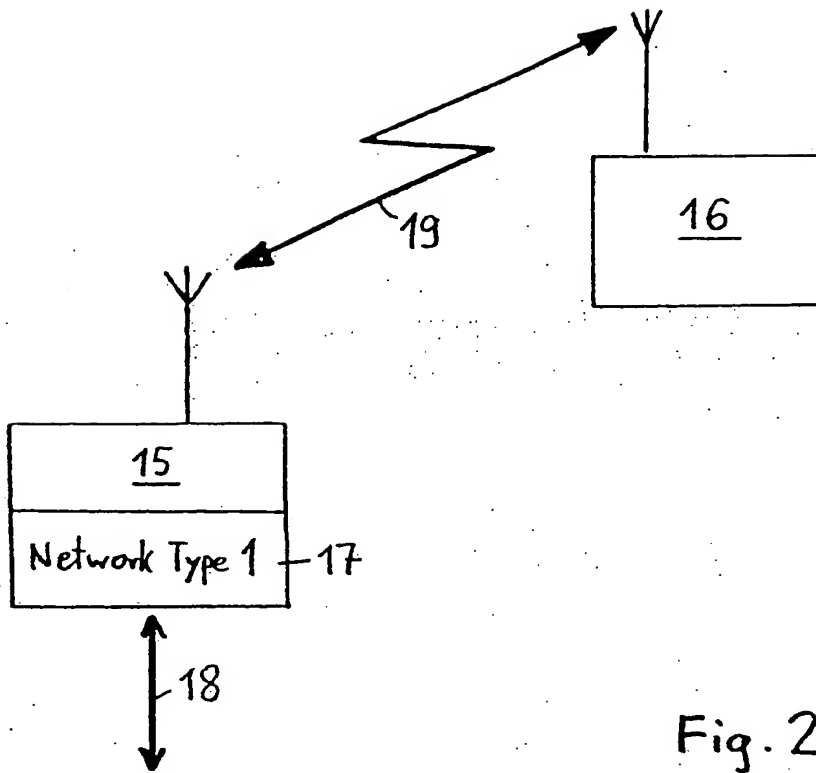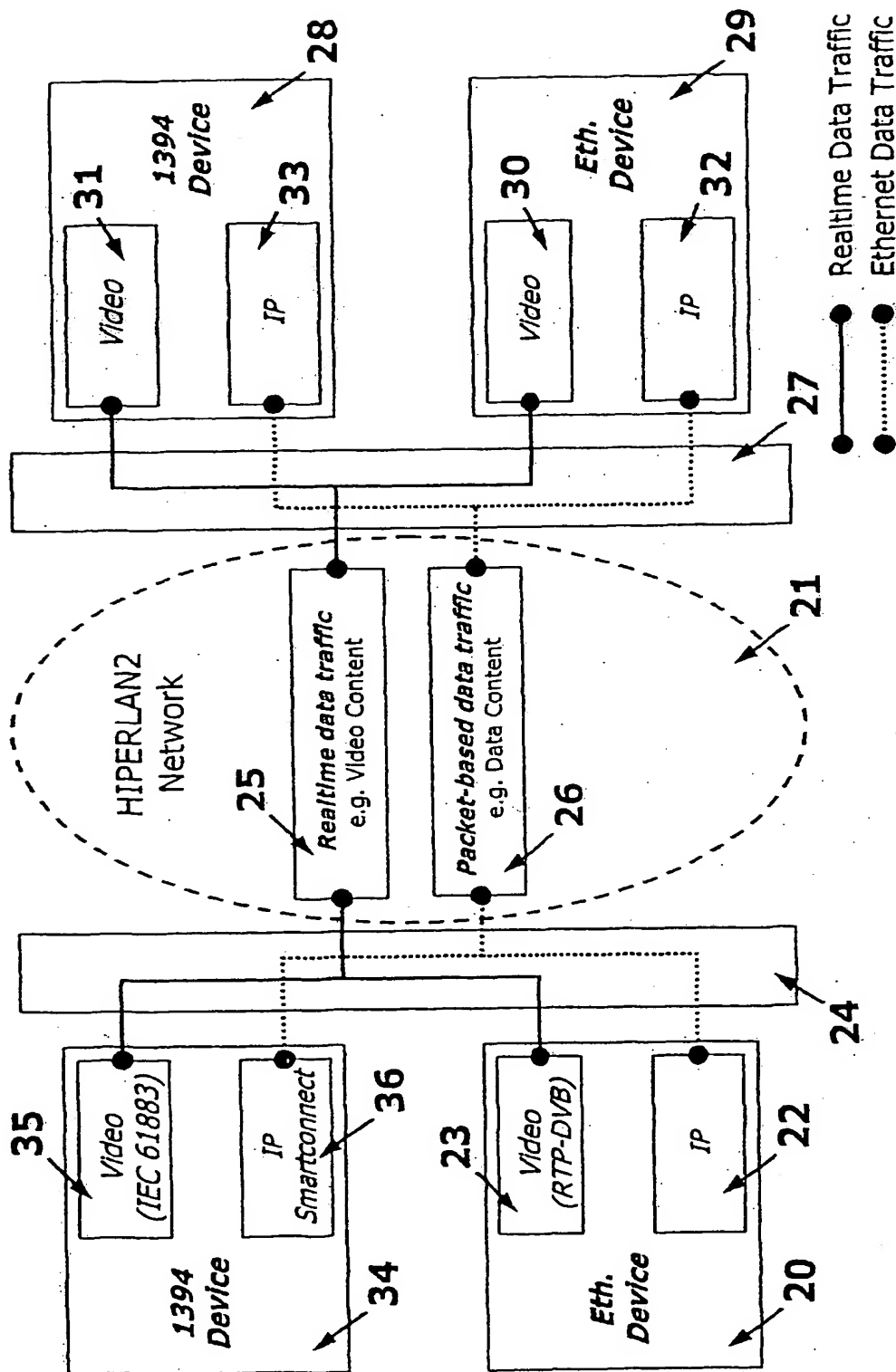Figure 1

16

19

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Network Type 1 —17

18

Fig. 2
Prior Art
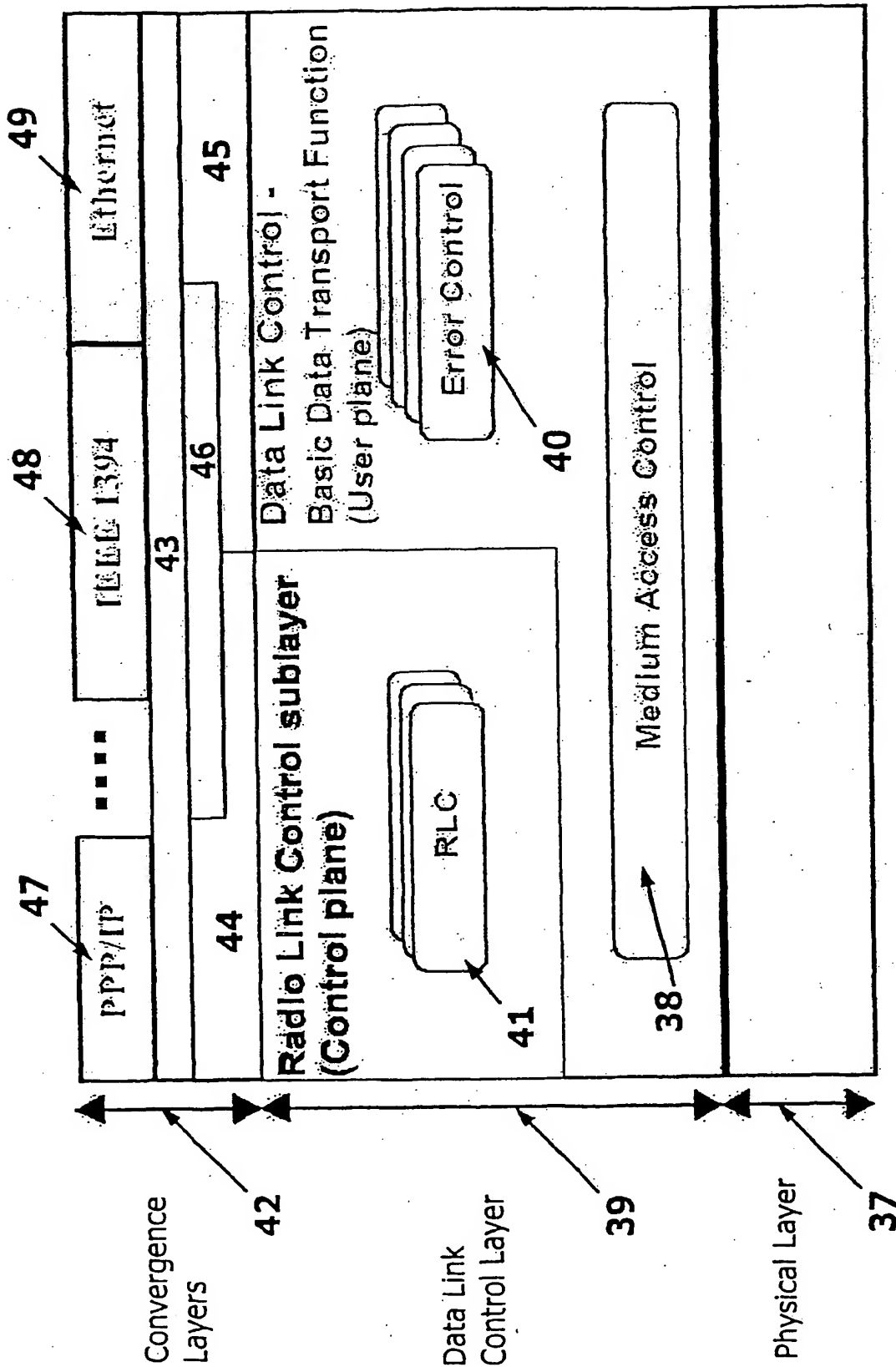
Figure 3

Figure 4
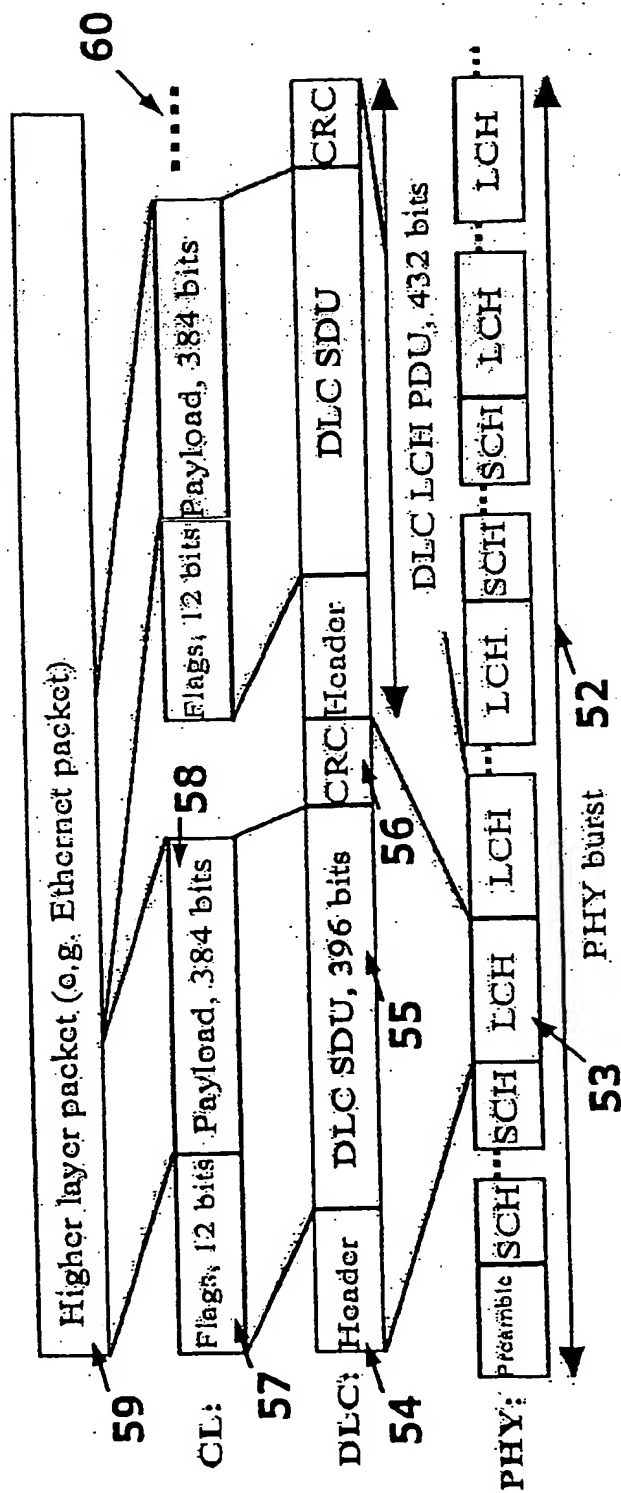
Figure 5

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7   H04L29/06   H04L12/56

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7   H04L

Documentation searched other than minimum documentation to the extent that such documents are Included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	WO 00 13436 A (NOKIA OY AB ;SODERLUND TOM (FI); MIKKONEN JOUNI (FI); ALA LAURILA) 9 March 2000 (2000-03-09) figures 8,10 ---	11,14
X	EP 1 148 687 A (ERICSSON TELEFON AB L M) 24 October 2001 (2001-10-24) column 9, line 41 —column 9, line 54 column 12, line 6 —column 12, line 16; figures 1-7 --- -/--	1,21,24

[X] Further documents are listed in the continuation of box C.   [X] Patent family members are listed in annex.

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'P' document published prior to the International filing date but later than the priority date claimed

'T' later document published after the International filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the Invention

'X' document of particular relevance; the claimed Invention cannot be considered novel or cannot be considered to Involve an Inventive step when the document Is taken alone

'Y' document of particular relevance; the claimed Invention cannot be considered to Involve an inventive step when the document Is combined with one or more other such documents, such combination being obvious to a person skilled In the art.

'&' document member of the same patent family

Date of the actual completion of the International search	Date of mailing of the International search report
24 November 2003	02/12/2003

| Name and mailing address of the ISA
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016 | Authorized officer

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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